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Evaluation of Historical Inns within the Scope of Biophilic Patterns

Tarihi Hanların Biyofilik Örüntüler Kapsamında Değerlendirilmesi

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ABSTRACT

Biophilic design is an approach that strengthens the bond between nature and humans. Examining the compatibility of historical and cultural heritage with biophilic design principles can guide environmentally friendly and sustainable design approaches for today's buildings. In line with this objective, this study comparatively analyzes seven inns (Sarıhan, Alayhan, Ağzıkarahan, Sultanhanı, Tepesidelikhan, Merzifonlu Kara Mustafa Paşa Caravanserai and Dolay Han) and four Roman mansiones (Mansiones Romana Convento di Sant'Antuono, Mansio Romana De Aquis Origins, Thésée Loir et Cher Mansiones and Cold Knap Roman Mansio) in the Cappadocia region in terms of biophilic design principles. In this qualitative study, spatial and visual analyses were conducted within the scope of 14 biophilic design principles developed by Browning et al. (2014). The findings reveal that both building types establish strong connections with nature, especially in criteria such as the use of natural materials, passive air conditioning solutions, natural light and ventilation, interior-courtyard relationship and shelter. However, some biophilic elements such as the water element, biomorphic forms, risk/hazard and dynamic light were used partially or in a limited way in both inns and mansiones. In conclusion, these buildings reflect many aspects of biophilic principles in the historical context and emphasized that traditional architecture can be a strong reference source for modern biophilic design.

Keywords: Inn, caravanserai, mansiones, Cappadocia, biophilic approach.

ÖZ

Biyofilik tasarım doğa ile insan arasındaki bağı güçlendiren bir yaklaşımdır. Tarihi ve kültürel mirasın biyofilik tasarım ilkeleriyle uyumunu incelemek, günümüz yapıları için çevre dostu ve sürdürülebilir tasarım yaklaşımlarına rehberlik edebilir. Bu hedef doğrultusunda çalışmada Kapadokya bölgesindeki yedi han (Sarıhan, Alayhan, Ağzıkarahan, Sultanhanı, Tepesidelik Han, Merzifonlu Kara Mustafa Paşa Kervansarayı ve Dolayhan) ile Roma Dönemine ait dört mansiones yapısının (Mansiones Romana Convento di Sant'Antuono, Mansiones Romana De Aquis Origins, Thésée Loir et Cher Mansiones ve Cold Knap Roman Mansiones) biyofilik tasarım ilkeleri açısından karşılaştırmalı analiz edilmektedir. Nitel araştırma yönteminin kullanıldığı çalışmada Browning et al. (2014) tarafından geliştirilen 14 biyofilik tasarım ilkesi kapsamında mekansal ve görsel analizler gerçekleştirilmiştir. Elde edilen bulgular, her iki yapı türünün de özellikle doğal malzeme kullanımı, pasif iklimlendirme çözümleri, doğal ışık ve havalandırma, iç mekan-avlu ilişkisi ve sığınma gibi kriterlerde doğayla güçlü bağlantılar kurduğunu ortaya koymuştur. Ancak hem hanlarda hem de mansioneslerde su öğesi, biyomorfik formlar, risk/tehlike ve dinamik ışık gibi bazı biyofilik unsurlar kısmen ya da kısıtlı bir şekilde kullanılmıştır. Sonuç olarak, bu yapılar tarihi bağlamda biyofilik ilkelerin birçok yönünü yansıtmaktadır ve geleneksel mimarinin modern biyofilik tasarım için güçlü bir referans kaynağı olabileceğini vurgulamıştır.

Anahtar Kelimeler: Han, kervansaray, mansiones, Kapadokya, biyofilik yaklaşım.

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Introduction

Throughout history, trade routes have been one of the most important elements of economic, cultural, and social interaction between civilizations. The need for accommodation for the traders, clergy, and government officials traveling on these routes has led to the emergence of various building types in different periods. The most important of these structures are inns and accommodation facilities known as mansiones. Mansiones were accommodation structures built on extensive road networks during the Roman Empire.

Augustus' establishment of the "curcus publicus", an official communication system to keep Rome informed of what was happening in each province, led to the creation of mansiones, official accommodation facilities on the roadsides (Adam, 1994). These buildings, which began to develop from the 2nd century BC, were initially simple accommodation units, but over time they evolved into a complex structure with additional functions such as courtyards, baths, stables and storage areas. With the fall of the Roman Empire, mansiones lost their functions over time, but inspired the development of medieval inns in terms of architecture and organization. This architectural and organizational continuity has been noted in many typological studies highlighting the influence of Roman infrastructure on Seljuk and medieval Anatolian architecture (Adam, 1994; Erdmann, 1966; Colmenero, 1996). The use of courtyards, stables and fortified walls reflects the spatial logic inherited from the Roman travel infrastructure. By the Middle Ages, accommodation structures along trade routes underwent a significant evolution, especially Seljuk inns and caravanserais. During the Anatolian Seljuk period, inns were constructed on main arteries to provide safe accommodation for traders and travelers. These buildings, which were usually located within a day's travel distance, were called Sultanhanı or caravanserai when they were built by sultans (Arseven, 1946). Inspired by the nomadic Turkish tribes in Central Asia and Roman mansiones, the inns became an important representative of Seljuk architecture and had a great influence on the accommodation structures built in the following periods (Yakar et al., 2007).

Cappadocia is one of the main regions where inns are commonly seen in Anatolia. During the Roman, Byzantine and Seljuk periods, Cappadocia was a strategic crossroads where military and trade routes intersected. Cappadocia, where the Silk Road, one of the busiest trade routes of Anatolia, passed, was located at the center of the commercial line extending from Iran to Erzurum, Sivas, Kayseri, Nevşehir, Aksaray and Konya. In addition, thanks to the connections to Aleppo, Elbistan, Sivas, Kayseri, Nevşehir and Konya, the commercial and cultural development of the region has continued for centuries (Gökhan, 2018). The intensive trade network in the region increased the need for accommodation and led to the construction of many inns in Cappadocia (Pekin, 2001). The inns built in Cappadocia were spread at different points along the trade routes and represented various spatial contexts due to their strategic locations. Although the list of these inns varies in various sources (Ökse, 2005; Özergin, 2011; Tuncer, 2007), the inns that survive in the region today are: Alayhan, Sarıhan, Ağzıkarahan, Sultanhanı, Öresinhan, Merzifonlu Kara Mustafa Paşa Caravanserai and Dolayhan (Figure 1). These structures were built according to different geographical and climatic conditions, taking into account the transit points on trade routes.

Roman mansiones, which were used for accommodation purposes like the inns in Cappadocia, inspired the medieval inns in Cappadocia and Anatolia. There are very few surviving examples of these mansiones dating back to the 2nd century BC. Built about a thousand years before the medieval inns, mansiones are located on important trade routes in countries such as Italy, Greece, Spain, France and Bulgaria. In this study, four surviving mansiones in different parts of the world are analyzed: Mansiones Romana Convento di Sant'Antuono in Italy, Mansiones Romana De Aquis Origins in Spain, Thésée Loir et Cher Mansiones in France and Cold Knap Roman Mansiones in Wales.

Figure 1.
The inns in the Cappadocia Region and the Mansiones in the European Continent examined within the scope of the study

Biophilic Design Approach

From past to present, the patterns, forms, processes and shapes of nature have existed in living spaces. However, due to reasons such as increasing urbanization and building design, the human relationship with the environment in modern civilizations has reached a breaking point (Kellert, 2012; Turner et al., 2004). In this context, biophilic design, as a design philosophy in recent years (Gillis & Gatersleben, 2015), aims to integrate natural elements and systems into the built environment to provide people with the exposure to nature they need (Kellert, 2008). Because many studies have shown that the connection with nature in education, work, health and living environments provides benefits and reduces stress (Abdelaal & Soebarto, 2019; Mangone et al., 2017; Peters & D'Penna, 2020; Sanchez et al., 2018; Yin et al., 2018). The spaces produced through buildings designed with a biophilic design approach create positive environmental impacts between nature and humans (Kellert, 2005, p.107). Therefore, in the field of design and architecture, there is increasing interest in the effects of nature on humans in buildings (Almusaed & Almssad, 2006; Coburn et al., 2019; Joye, 2007; Kellert, 2008; Mutlu-Avinç, 2024; Salingaros, 2015; Sanchez et al., 2018; Soderlund & Newman, 2015; Yin et al., 2018). Biophilic design is an important strategy for strengthening the bond between nature and humans. Examining the extent to which historical and cultural heritage overlaps with biophilic design principles can inspire today's architecture. It contributes to local sustainable design approaches. At the same time, it creates an academic ground for how strategies used in the past can be integrated into today's buildings.

The design concept known as biophilic design encourages the use of natural processes, patterns and systems in the creation of the built environment (Kellert, 2008). Biophilia is defined as the deep-rooted human need to connect with nature (Ryan et al., 2014). The Biophilia hypothesis (Wilson, 2017), which argues that exposure to the natural world is crucial to human well-being because of our fundamental connection to it, forms the basis of biophilic design. Kellert (2008), one of the pioneers of biophilic design, defines the biophilic design approach as "a deliberate attempt to satisfy the need of contact with natural systems and processes in the contemporary built environment, and to improve people's physical and mental health, productivity and wellbeing". Similarly, Browning et al. (2014) define biophilic design as 'the inherent human affinity to affiliate with natural systems and processes'. Sturgeon (2017) explains the concept of biophilic design as "... the deliberate incorporation of elements from nature into the built environment". Biophilic design patterns have been developed by different researchers to examine the effects

of biophilic design (Browning et al., 2014; Kellert & Calabrese, 2015). Biophilic design features are expressed by Stephen Kellert and Elizabeth Calabrese (2015) with a total of 24 principles under three headings (Table 1).

Table 1.
Biophilic design experiences and attributes by Kellert and Calabrese (Kellert & Calabrese, 2015)

Direct Experience of Nature	Indirect Experience of Nature	Experience of Space and Place
Light	Images of Nature	Prospect and refuge
Air	Natural materials	Organized complexity
Water	Natural colours	Integration of parts to wholes
Plants	Simulating natural light and air	Transitional spaces
Animals	Naturalistic shapes and forms	Mobility and wayfinding
Weather	Evoking nature	Cultural and ecological attachment to place
Natural landscapes and ecosystems	Information richness	
Fire	Age, change and the patina of time	
	Natural geometries	
	Biomimicry	

Browning et al. (2014) classified biophilic design features with 14 principles under 3 headings: Nature in the Space Patterns, Natural Analogues Patterns and Nature of the Space Patterns (Table 2).

Based on the classification principle of Browning et al. (2014), this study evaluates Cappadocian inns and Roman mansiones. Biophilic design is an approach that strengthens the bond between nature and humans, and examining how this concept overlaps with traditional architecture can contribute to the understanding of modern sustainable design. In this context, when the studies in the literature are examined, Demir and Söğüt (2024) found that the psychological well-being and quality of life of the users increased significantly in spaces where biophilic design was used. In the study of Özğan and Aluçlu (2023), it was determined that the interest in biophilic design in academic publications is gradually increasing. Terblanche & Khumalo (2024) found that workspaces with biophilic design evoke positive emotions in students and increase their energy levels.

Determan et al. (2019) showed that the implementation of biophilic design in classrooms reduces student stress and improves learning outcomes. Ramzy (2015) examined the impact of biophilic design on religious buildings such as temples, cathedrals, and mosques, and suggested that these design elements can serve as inspiration for contemporary buildings. Tu (2022) examines the role of biophilic principles in the management of historical heritage. It was determined that biophilic design can be effective in sustainable conservation strategies. Based on the research in the literature, this study investigates the presence of biophilic design elements in inns and mansiones as a building type that has not been examined before. How biophilic elements evolved from mansiones to inns in the historical process is analyzed according to the classification principle of Browning et al. (2014).

Table 2.
Biophilic design patterns developed by Browning (Ryan & Clancy, 2014)

Theme	Pattern	Explanation
Nature in the Space Direct Experience	Visual Connection with Nature	View to elements of nature, living systems, and natural processes
	Non-Visual Connection with Nature	Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems, or natural processes.
	Non-Rhythmic Sensory Stimuli	Stochastic and ephemeral connections with nature that may be analysed statistically but may not be predicted precisely.
	Thermal and Airflow Variability	Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments
	Presence of Water	A condition that enhances the experience of a place through seeing, hearing, or touching water
	Dynamic and Diffuse Light	A condition that enhances the experience of a place through seeing, hearing, or touching water
	Connection with Natural Systems	Leverages varying intensities of light and shadow that change Over time to create conditions that occur in nature
Natural Analogues Indirect Experience	Biomorphic Forms and Patterns	Symbolic references to contoured, patterned, textured, or numerical arrangements that persist in nature
	Material Connection with Nature	Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place
	Complexity and Order	Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature
Nature of the Space Indirect Experience	Prospect	An unimpeded view over a distance, for surveillance and planning.
	Refuge	A place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.
	Mystery	The promise of more information, achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.
	Risk/Peril	An identifiable threat coupled with a reliable safeguard.

Browning's model was preferred in the study as it provides a systematic framework for analyzing historical heritage. Within the scope of the study, biophilic design principles in inns and mansiones were compared. Comparing these two building types aimed to identify the commonalities and differences between the Roman accommodation culture and the inns developed by the Seljuks. Biophilic design has been a fundamental element of architectural development in different civilizations. The unique geological formations of Cappadocia have enabled the inns in the region to integrate with natural elements. However, it is important to compare them with other culturally significant accommodation structures, such as the Roman Mansiones, in order to examine in more depth how biophilic principles have been integrated in historical buildings. In this way, similarities and differences in the application of biophilic design principles between different geographical locations and periods are revealed.

Material and Methods

This study is based on qualitative research methodology and includes a comparative analysis of seven inns and four mansiones of the Roman Empire in the Cappadocia region within the framework of biophilic design principles. The research is based on the biophilic design model developed by Browning, Ryan and Clancy (2014), which consists of 14 principles. Data were collected through literature review, on-site observation, visual documentation and spatial analysis methods; the plan schemes, architectural elements, material use and environmental relations of the buildings were evaluated according to these principles. The findings are presented within the framework of an interpretive analysis aimed at understanding the relationships between the buildings and natural systems. With this method, the biophilic design potentials of both the inns and the mansiones were revealed with a holistic approach in climatic, spatial and historical context.

Table 3.
Flowchart of the study

Determination of the research question	Presence of biophilic design principles in Cappadocian inns and Roman maansiones
Research Methodology	Qualitative analysis method
Selection of study area and sample	Sarıhan, Alayhan, Ağzıkarahan, Sultanhanı, Öresin Han (Delikhan / Tepesidelikhan), Merzifonlu Kara Mustafa Paşa Kervansarayı, Dolayhan, Mansiones Romana Convento di Sant'Antuono, Mansiones Romana De Aquis Origins, Thésée Loir et Cher Mansiones, Cold Knap Roman Mansiones
Data collection	Literature review Spatial analysis (plan layout, use of materials, indoor-outdoor relationship) On-site observation and photographic documentation
Evaluation of biophilic design principles	The model developed by Browning, Ryan & Clancy Nature in the Space Patterns Natural Analogues Patterns Nature of the Space Patterns
Data analysis	Identification and comparison of biophilic features in inns and mansiones by content analysis method
Conclusion	Creating future projections

Results

In this part of the study, architectural data on inns in the Cappadocia region and mansiones in Rome are presented. Afterwards, these two building types were evaluated within the scope of biophilic features and summarized comparatively in a table.

Sarıhan

Sarıhan Caravanserai is located within the borders of Nevşehir on the Aksaray-Kayseri route (Akok & Özgüç, 1956). The 13th century building has an area of approximately 2000 square meters. The building consists of a square courtyard used for summer and a rectangular enclosed section used for winter (Karaçağ, 2007) (Figure 2). In the courtyard of the building, there is a pavilion masjid and a monumental crown gate connecting to the courtyard. There are towers at the outer corners of the closed and open sections and a lighthouse in the center of the closed section. Tuff stone, one of the local materials, was used in the building. These stones are yellow colored volcanic smooth cut stones, which also gave the caravanserai its name (Aslanapa, 2017). There are floral, animal and geometric decorations in various parts of the building (Karaçağ, 2007). Sarıhan underwent various restorations between 1985, 1987-1990, 1993-1994 (Dursun, 2016; Karaçağ, 2007; Özgüç & Akok, 1956). Since 1996, the inn has been used for various cultural events.

Figure 2.
Schematic plan of Sarıhan, Karaçağ, 2007; view from the Sarıhan crown gate (from the first author's archive)

Alayhan

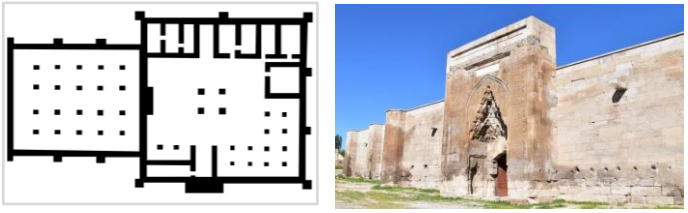
Alayhan, also called Pervane Inn, is located on the Aksaray-Nevşehir highway (Deniz, 2007). According to Aslanapa, it was built during the reign of Sultan İzzüddin Kılıçarslan II (1156-92) (Aslanapa, 1993). According to Erdmann, the exact construction date of the building is unknown, but he states that it may have been built between 1180-1200 AD in terms of its ornamental features (Erdmann, 1966). Alayhan is the pioneer of the Sultan khans type (Altun, 1989). Today only the closed section of the inn is in use except for the damaged parts (Figure 3) (Deniz, 2007). In the closed section, there is a skylight lantern in the middle area where the pitches intersect. The building was constructed with rubble stone in masonry technique and red colored smooth volcanic cut stones were used (Konyalı, 1974). The crown gate of the building draws attention in terms of ornamentation. There is a single-headed, double-bodied lion figure on the crown gate (Deniz, 2007). There are also geometric and floral ornaments on the crown gate (Ögel, 1962). Alayhan, where comprehensive excavation and cleaning work was carried out in 2008-2011, is used as a private facility for various cultural activities.

Figure 3.
Schematic plan of Alayhan (Ögel, 1962); view from the Alayhan crown gate (from the first author's archive)

Ağzıkarahan

Located on the old route of Aksaray-Nevsehir highway, it is 15 km away from Aksaray. Although the date of construction is uncertain according to the inscriptions, according to Erdmann it was built between 1231 or 1239-40 (Erdmann, 1966). Altun, on the other hand, puts the construction date as 1236-1240 (Altun, 1988). The closed part of the inn, which was used as winter quarters, was built first, while the courtyard, which was used as summer quarters, was added later. The courtyard is square in plan and the closed section is rectangular (Figure 4). There is a skylight lantern on the center landing of the closed part of the building. There is a pavilion masjid in the center of the open part of the building. The inn was built of cut stone with masonry construction technique. The building is also very rich in terms of ornamentation. Geometric and floral motifs were used (Özgüç & Akok, 1956). The damaged parts of the inn were restored between 1964-65 and 1970-75 (Yetiş & Kaygısız, 2017; Çetintürk, 1986). At the same time, the building underwent a comprehensive restoration process in 2008 and has been serving as a museum since then (Yıldırım, 2017).

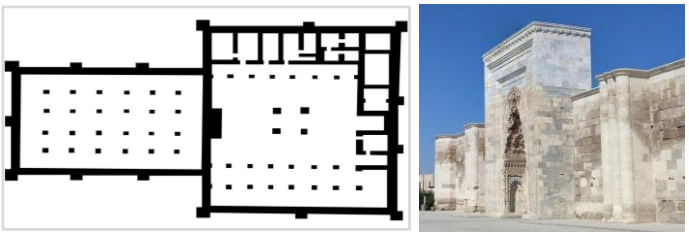
Figure 4.
Schematic plan of Ağzıkarahan (İlter, 1969); View from the crown gate of Ağzıkarahan (from the first author's archive)



Sultanhanı

The inn is located between Aksaray and Konya, 40 km away from Aksaray (İlter, 1969; Özergin, 1965). It was built in the 13th century by Sultan Alaeddin Keykubad I (Önge, 1985). The building consists of a closed space and an open courtyard surrounded by porticoes (Figure 5) (Dursun, 2016). There is a lighthouse in the center of the closed section. In the center of the open courtyard is a pavilion masjid (Durukaya, 2007; Uluçam, 2009). The building was constructed with masonry wall technique and white and dark colored marble was used in the portals and volcanic smooth cut stone was used in other parts. In terms of ornamentation, geometric, floral and animal decorations were used (Erdmann & Erdmann, 1976; Konyalı, 1974). The repairs that the inn, which is on the UNESCO World Heritage Tentative List, has undergone cover the years 1268-69, 1959-1968, 2017-2019 respectively. With the restoration work completed in 2019, Sultanhanı started to serve as a tourism facility (Aslanapa, 1983).

Figure 5.
Schematic plan of Sultanhan (İlter, 1969); View from the entrance facade of Sultanhan (from the first author's archive)



Öresinhan/Delikhan/Tepesidelikhan

It is 12 km to Alayhan and 6 km to Ağzıkarahan. According to the inscription of the building, it was built in the 13th century during the reign of Kılıçarslan II (Baş, 2009). According to Erdmann, the plan and construction technique suggest that the inn may have been built towards the end of the 13th century (Erdmann, 1966). Named after the nearby village of Tepesi Delik, today only the closed part of the building exists, and it is not known whether it had an open courtyard or not (Figure 6) (Çetintürk, 1986). The façade and portal of the inn, which has a rectangular plan without a courtyard, have been demolished. In the center of the building is a raised lighthouse covered with a dome. The walls of the building built with masonry construction technique are rubble stone and covered with cut stone. The building was restored in 2009 and then started to serve as a cafeteria, restaurant and a private facility where souvenirs are sold.

Figure 6.
Schematic plan of Öresin han, Baş, 2009; View from the entrance facade of Öresin han (from the first author's archive)

Merzifonlu Kara Mustafa Pasha Caravanserai

The Caravanserai, located in İncesu between Kayseri and Nevşehir, was built in 1670 by Grand Vizier Merzifonlu Kara Mustafa Pasha. The building shows the building characteristics of the Ottoman classical period (Çayırdağ, 1988). The caravanserai is part of a complex and is adjacent to the arasta wall (Figure 7) (Nayır, 1975). The building has two sections, winter and summer. The closed section has a rectangular plan and the open section consists of a large courtyard surrounded by porticoes on three sides. There is a pavilion masjid in the middle of the courtyard. Red colored cut stone and rough masonry stone were used as materials. There is no ornamentation in the building (Özbek & Arslan, 2008). The building was restored between 1860-61, 1959-65 and 1972-75 (Denktaş, 1997). Since 2013, the building has been used for various organizations such as weddings and invitations.

Figure 7.
Schematic plan of Mustafa Pasha Caravanserai (Kuran, 2006); A view from the courtyard entrance of the caravanserai (from the first author's archive)

Dolayhan

It is located near the Til village of Derinkuyu in Nevşehir. Although there is no data on the construction date of the building, it is thought to date back to the 13th century (Özgüç & Akok, 1958). Today, the open courtyard of the building has been completely demolished and the skeleton of the closed section partially survives (Figure 8). It is understood from the drawings made by Akok and Özgüç that there were closed rooms and porticoes around the demolished courtyard of the building outside the village (Özgüç & Akok, 1958). Cut stone was used as material and red and light colored stones were used in the door arches. Today the building is in ruins and is located within the settlement area of Til village.

Figure 8.
Schematic plan of Dolay Khan, Yenipınar, 2006; A view of the current state of the inn (from the first author's archive)

Mansiones Romana Convento di Sant'Antuono

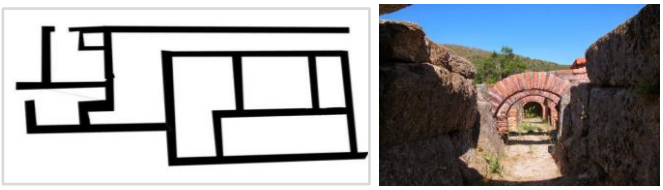
It is located near the Calaggio River in the Puglia region of Italy. Built during the Roman period for accommodation purposes, it was used as a monastery, hospital and shelter during the Middle Ages. The building has a square plan and was built of stone, brick and partly marble (Figure 9). The roof covering system was formed with a vault-shaped stone lattice system. The building was planned around an inner courtyard and accommodation units and stables surround the building (De Capraris, 2021).

Figure 9.
Schematic plan and current view of Sant'Antuono (De Capraris, 2021)

Mansiones Romana De Aquis Origins

It is a Roman complex in the Galicia region of Spain. It is located on a busy trade route around the Caldo River. The location of the building was influenced by the hot springs. Built during the Early Roman Empire, it consists of an inner courtyard, baths and accommodation units (Figure 10). Excavations were carried out between 1989-1995 in the building where red bricks and local stones were used. Since 1996, the building has been serving as an open-air museum (Colmenero, 1996).

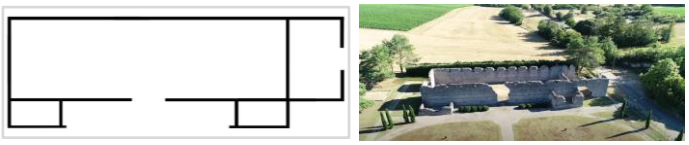
Figure 10.
Aquis Origins schematic plan and current view (Colmenero, 1996)



Thésée Loir et Cher Mansiones

It is located in the Loir-et-Cher region of France, on the banks of the Cher River on the ancient Roman road. It comprises a complex of buildings centered around a courtyard. It consists of accommodation, stables and a large rectangular monument (Figure 11). The monumental complex dates from the early 2nd century AD and was registered in 1841. The walls were constructed using the "Opus Spicatum" technique, in which the bricks are arranged at angles in a fishbone pattern (Adam, 1994).

Figure 11.
Loir et Cher schematic plan and current view (Adam, 1994)



Cold Knap Roman Mansiones

Cold Knap is a Roman building complex in Wales. Dating to the late 3rd century AD, the Mansiones is located on a point overlooking the Bristol Channel. Excavations were carried out in the 1960s. It is thought to have been a place of accommodation for ships moored in the Watch House harbor. It is a 22-room building arranged around an open courtyard (Figure 12). The walls were built of local limestone and the roof was constructed of ceramic tiles (Caruana & Morgan, 1996).

Figure 12.
Schematic plan and reconstruction of Cold Knap (Caruana & Morgan, 1996)

Analyzing the Inns in the Scope of the Study in the Context of Biophilic Approach Criteria

Nature in the Space

Nature in the Space addresses the direct, physical and temporary presence of nature in a space or place. This includes plant life, water and animals, breezes, sounds, smells and other natural elements. Common examples include potted plants, flower beds, bird feeders, butterfly gardens, water features, fountains, aquariums, courtyard gardens, and green walls or planted roofs. The most powerful Nature in the Space experiences are achieved by creating meaningful, direct connections with

these natural elements, especially through diversity, movement and multi-sensory interactions.

Visual connection with nature and natural systems: Describes places of vision to elements of nature, natural processes and living systems. It is the awareness of natural processes, especially seasonal and temporal changes, characteristic of a healthy ecosystem (Figure 13). Through courtyards, open spaces and natural materials, the Inns and Mansiones establish a visual unity with nature. These buildings offer the user the opportunity to observe natural processes and connect with nature through the play of light and shadow, the relationship with the landscape and nature motifs.

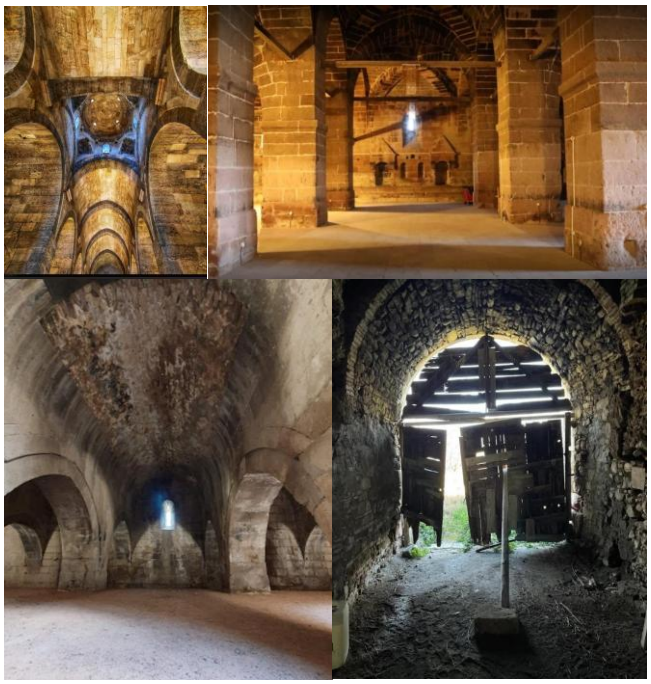
Figure 13.
Sultanhanı, Ağzıkarahan, Sarıhan (from the first author's archive), Sant'Antuono (De Capraris, 2021)

Non-Visual Connection to Nature: Design elements that establish the relationship with nature not only visually, but also through the auditory, tactile, olfactory or gustatory senses. These elements create a sense of continuous connection with nature in spaces through features such as acoustic representation of nature, the coolness of the stone material, natural light and ventilation. Thus, users feel the effects of nature through different sensory experiences (Figure 14). Inns and mansiones have an auditory and tactile connection with nature through stone materials and natural ventilation systems. With sensory elements such as the interaction of the wind with the stone walls and the coolness of the stones, these buildings create an environment where users can feel the effects of nature. Natural light and acoustic features reinforce the integration of the space with nature.

Non-Rhythmic Sensory Stimuli, Dynamic and Diffused Light: Design elements that reflect the ephemeral and unpredictable qualities of nature through the use of time-varying light intensities and shadows. This kind of light and shadow play presents nature not only as a background element, but also as a fluid and variable entity that constantly interacts with the space. It allows users to develop an awareness of the dynamic nature of nature (Figure 15). Inns and mansiones bring the ephemeral and dynamic characteristics of nature indoors through the play of light and shadow that changes over time. By reflecting the light conditions of the outdoor environment into the interior spaces, these structures allow users to develop an awareness of the ever-changing nature of nature. Light-shadow interactions make the living and fluid character of nature felt in the space.

Figure 14.
Sultanhanı, Sarıhan and Merzifonlu Kara Mustafa Pasha Caravanserai (from the first author's archive), Loir et Cher (Adam, 1994)

Figure 15.
Sultanhanı, Merzifonlu Kara Mustafa Paşa Inn, Ağzıkarahan (from the first author's archive), Sant'Antuono (De Capraris, 2021)



Temperature and Airflow Variability: Subtle changes in air temperature, humidity, airflow and surface temperatures inside the building are felt by the user. In design, the use of materials and structural features adapt to local climatic conditions and respond effectively to changes in temperature and airflow. This approach ensures that the space is in harmony with natural environments and makes it possible to feel climatic differences (Figure 16). Inns and mansiones are designed to be climate-compatible and resistant to temperature changes, using thick walls and local materials. These structures allow users to interact

with environmental conditions by allowing air flow and temperature variations to be felt naturally in interior spaces.

Figure 16.
Merzifonlu Kara Mustafa Pasha Inn (from the first author's archive)

Presence of Water: It refers to a condition that enhances the experience of a place by seeing, hearing or touching water (Figure 17). The presence of water elements in inns and mansiones is limited. Merzifonlu Kara Mustafa Pasha Inn has a water well, Sarıhan has a pool in the courtyard, and Aquis Origins has water elements as a bath system.

Figure 17.
Merzifonlu Kara Mustafa Pasha Inn, Sarıhan (from the first author's archive), Aquis Origins

Natural Analogs

Natural elements appear as shapes, sequences and patterns in textiles, furniture, decoration, artworks and interiors. Imitations of shells and leaves, furniture with organic forms, and natural materials that have been processed (e.g. granite table surfaces or wood planks), although not real, offer experiences that are analogous to natural states of nature, creating an indirect, if not literal, connection to nature. These elements create the most powerful natural analog experiences, providing information in consistent or variable forms.

Biomorphic Forms and Patterns: Design elements with organic and fluid lines inspired by living organisms in nature. These forms often mimic elements in natural structures such as soft curves, cell structures, leaf veins and seashells (Figure 18). The use of floral, geometric and animalistic figures and patterns is common in both mansiones and inns, especially on the entrance doors. Mansiones are simpler and plainer structures in this context. The use of mosaics in various patterns is common in floor coverings. Inns, on the other hand, are richer in terms of ornamentation than mansiones.

Figure 18.
Ağzıkarahan, Sultanhan, Alayhan (from the first author's archive), Sant'Antuono (De Capraris, 2021)

Material Connection to Nature: The use of natural materials and components in building design to create a physical relationship with nature. This approach involves integrating materials that reflect the local geology or ecology into the building with minimal modification. Thus, the building gains a character unique to its location and becomes harmonious with its surroundings (Figure 19). In inns and mansiones, natural materials such as stone, brick, marble and wood are used to create a strong relationship with the environment.

Figure 19.
Merzifonlu Kara Mustafa Pasha Inn and Alay Inn (from the first author's archive), Loir et Cher (Adam, 1994)

Complexity and Order: Spaces are designed to be both systematic and open to exploration. In this approach, different spatial elements are connected in a hierarchical order so that users experience both a directed flow of movement and a natural transition as they explore the space. This balance allows the building to be functional while at the same time evoking a sense of curiosity and awareness in the user (Figure 20). By connecting spatial elements such as courtyards, corridors and porticoes in a hierarchical order, inns and mansiones offer a structure that is both organized and open to exploration. They provide the user with a directed flow of movement while at the same time allowing them to explore the space step by step.

Figure 20.
Sultanhanı, Mustafa Pasha Caravanserai (from the first author's archive), Aquis Origins

Nature of the Space

The Nature of Space explores spatial arrangements in nature, reflecting on the instinctive and learned impulses linked to the way we perceive our environment. This includes our desire to explore beyond our immediate surroundings, our interest in the unknown or dangerous elements, the interplay of ambiguous landscapes and illuminating moments, and spatial characteristics that can sometimes lead to phobias when combined with a sense of security. The most compelling experiences of the nature of place are achieved through deliberate and curious spatial arrangements that integrate with nature and natural analog patterns in space.

Prospect: The ability to have a wide and unobstructed view of the environment from a space. This design principle gives the user a sense of security, control and direction, while at the same time increasing the sense of openness and spaciousness of the space. Open spaces, passageways and unobstructed views enrich the spatial experience and create a visual connection with nature (Figure 21). Large courtyards in inns and mansiones provide the user with an unobstructed view of the surroundings.

Figure 21.
Merzifonlu Kara Mustafa Pasha Inn, Merzifonlu Kara Mustafa Pasha Inn (from the first author's archive)

Refuge: The design of sheltered spaces where the individual feels safe from environmental threats or external stimuli. This principle of biophilic design refers to spaces that provide protection, especially from undetectable areas, closed to the outside but offering a peaceful environment within. Such spaces give the user a sense of security and relaxation, both physically and psychologically (Figure 22). Inns and mansiones offer safe havens against external threats with their thick high walls, inward facing plans, niches and shelters.

Figure 22.
Merzifonlu Kara Mustafa Pasha Inn, Ağzıkarahan (from the first author's archive), Sant'Antuono (De Capraris, 2021)

Mystery: It is a design approach that arouses curiosity in the user and creates a desire to explore by not being able to see the entire space at a glance. This principle enriches the spatial experience through methods such as gradual planning of transitions and the use of light and shadow play. The user encounters new spaces as they move through the space, creating an engaging and dynamic atmosphere that is far from ordinary (Figure 23). Inns and mansiones arouse a sense of curiosity in the user with gradual transitions, narrow corridors and limited visibility.

Figure 23.
Ağzıkarahan, Ağzıkarahan, Merzifonlu Kara Mustafa Pasha Inn (from the first author's archive), Loir et Cher (Adam, 1994)

Risk/Hazard: It is a biophilic design principle that creates a sense of attention, curiosity and arousal in the user by creating controlled and limited uncertainties without completely eliminating the sense of trust in space design. Subtle elements of risk in a safe environment (low lighting, narrow passageways or unpredictable spatial transitions) allow users to establish a deeper sensory relationship with the space. This balance creates a rich spatial atmosphere that both feels protected and allows the experience of nature's unpredictability (Figure 24). In inns and mansiones, elements such as narrow passageways, dimly lit spaces and limited visibility create a sense of risk/danger by creating a controlled uncertainty. This design language allows to experience the unpredictability of nature in a secure structure.

Figure 24.
Ağzıkarahan, Alayhan (from the first author's archive), Sant'Antuono (De Capraris, 2021), Loir et Cher (Adam, 1994)

Table 4 compares Cappadocian inns and Roman mansiones in terms of biophilic criteria and summarizes the differences. The temporal difference of about a millennium between the two building types has created significant differences in terms of construction systems, material use, architecture and ornamentation. Therefore, these differences are also reflected in the space in terms of the relationship with nature. As medieval buildings, Cappadocian inns offered more visually rich experiences with nature. In Roman mansiones, functionality and security limited the relationship with nature. With the development of construction systems in the Middle Ages, there are closed spaces with wide openings. In Roman mansiones, on the other hand, closed spaces are smaller due to the limitations of construction systems. The development of construction systems in inns allowed for spatial richness and diversity, creating more dynamic effects in the interior.

Conclusion

Within the scope of the study, seven inns in the Cappadocia region and four Roman mansiones located in different regions of the European Continent were evaluated within the framework of biophilic design principles. Analyses conducted in line with the 14 biophilic design principles put forward by Browning et al. (2014) have shown that both building groups have established strong relationships with nature. Cappadocia Inns, with their courtyards, thick stone walls and use of natural materials, establish strong visual and tactile connections with nature. Sustainable approaches such as temperature control through passive air conditioning systems and natural ventilation are especially prominent. Roman mansiones also supported the flow of natural light and air with their inner courtyard, atrium and peristyle arrangements. Both building types have spatial arrangements that support interaction with nature within their functional organization.

Table 4.
Comparison of biophilic criteria of Cappadocian Inns and Roman Mansiones

Variable	Cappadocia Inns	Roma Mansiones
Visual connection with nature and natural systems	The courtyard, window openings and luminous lanterns provide a direct visual connection to the sky.	The visual connection with nature is provided by the courtyard and window openings.
Non-visual connection with nature	Stone structures provide coolness; there are acoustic elements that interact with the wind. Smell, texture and sound support the experience of nature.	There is a sense of sound and heat with functional spaces such as a bath. The tactile connection is strong with natural material choices.
Non-rhythmic sensory stimuli	The play of light and shadow is prominent in the crenellations, under-arch spaces and vaulted transitions.	Variable light effects are created through window openings and interior spaces.
Heat and airflow variables	Thick stone walls provide thermal insulation. Natural ventilation is supported by porticoes and courts.	Air circulation is provided through courtyards and semi-open spaces. Stone and brick materials create a thermal balance.
Presence of water	Some inns have water elements in the courtyards.	Water is used for functional (bathing) purposes. The biophilic connection with the sound of water is strong.
Biomorphic forms and patterns	The facades contain geometric, floral and animal ornaments.	Vegetal and animal forms are frequently used on mosaic floors.
Material connection with nature	Local stone and wood materials are used.	In addition to stone and wood, brick and mosaic are also used.
Complexity and order	There is hierarchy and flow between the courtyard, passageway and rooms.	Functional areas are placed in a systematic and modular layout.
Prospect	Large courtyards and open passageways provide a view of the surroundings.	More introverted. Limited peripheral vision.
Refuge	It consists of high and thick walls.	It consists of high and thick walls.
Mystery	The mysterious space effect is high with gradual transitions, porticoes, and corridors.	Mysteriousness is partly lower because it does not involve large, closed volumes.
Risk/Peril	Labyrinthine interior passages offer a balance of risk and trust.	There is less element of risk in designing against environmental threats.

However, some biophilic design elements are missing or limited in both buildings. In Cappadocian inns, the elements of water and fire were generally symbolic, the water element was used only in a limited way in some inns, and fire was not included in the design as a spatial element. In Roman mansiones, although the water element was used in a more functional way (baths), it was determined that some principles such as visual openness (prospect) and risk/hazard, which offer direct contact with nature, were included at a more limited level. The inns of Cappadocia have established an indirect connection with nature in line with the region's arid climate, limited vegetation and socio-economic conditions, while the Roman mansiones have supported a direct connection with nature by being located in greener environments under the influence of the Mediterranean climate. The spatial organization and material choices of both groups of buildings offer passive sustainability solutions in line with biophilic design principles.

While the integration of natural elements into space and sustainable design understanding is gaining importance in today's architecture, the study of historical inns in the context of biophilic design reveals traditional solutions that can inspire modern architecture.

This research shows that historical buildings can be evaluated in terms of biophilic design principles and that these evaluations can guide modern architectural design processes. In particular, the use of local materials, natural ventilation strategies and courtyard arrangements can guide future projects in terms of energy efficiency and sustainable space design. Future research can examine how cultural heritage can be integrated with sustainable architecture in a broader perspective by considering historical buildings in different regions in terms of biophilic design principles. In particular, it is recommended to conduct more detailed studies on how the missing elements of biophilic design can be completed and how traditional architecture can be integrated into sustainable urbanism.

By revealing how biophilic design principles are applied in accommodation spaces, this study provides important clues for the sustainable restoration of historical buildings and the development of design approaches that integrate with nature in modern architectural projects. In line with the findings, the following suggestions are offered on how biophilic principles can be utilized in modern restoration processes of historic buildings and future architectural projects: Passive air conditioning systems should be preserved and modernized, natural ventilation and thermal advantages of stone should be used sustainably. The use of natural light in historic buildings should be increased, and spatial illumination should be supported by preserving glass openings and light lanterns. Biophilic elements such as water elements and plant use should be emphasized in restoration processes, and green space integration should be strengthened. Traditional courtyard layouts can be reinterpreted in contemporary buildings to provide an indoor connection with nature. Artificial intelligence-supported simulations can be used to optimize the contribution of biophilic design to energy efficiency. Furthermore, sustainable architecture should be supported by adapting materials such as local stone and wood from historic buildings to modern projects.

This study differs from previous literature by making a typological and functional comparison between Roman mansiones and medieval inns in Cappadocia through the lens of biophilic design principles. While many studies focus on the environmental or psychological implications of biophilic design in contemporary architecture, this research uniquely evaluates historic hospitality structures in terms of spatial and sensory features that are compatible with biophilic qualities. By revealing how nature-oriented design strategies were embedded in pre-modern architecture, the study extends the scope of biophilic design beyond modern practices, bringing an interdisciplinary

perspective to architectural history and sustainability studies. Future studies could expand the geographical scope to include other types of historic accommodation, such as Byzantine xenodoxy or Ottoman ribats, allowing for a broader historical continuum. In addition, a quantitative evaluation model integrating user experience and physiological measurements could improve the assessment of biophilic features in historic buildings. Comparative digital simulations and post-occupancy evaluations of restored buildings would also enrich the applicability of biophilic principles in heritage conservation.

In conclusion, biophilic design principles play a key role in both the preservation and sustainable restoration of historical heritage and in creating healthy living spaces in harmony with nature in the future. The application of these principles in future architectural projects will contribute to the creation of innovative spaces that provide ecological and psychological benefits by increasing human-nature interaction.

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